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REPORT

CD NO.

COUNTRY	USSR	DATE OF INFORMATION	1951
SUBJECT	Economic; Technological - Machine tools		
HOW PUBLISHED	Monthly periodical	DATE DIST. 29 Jan 1953	
WHERE PUBLISHED	Moscow	NO. OF PAGES	2
DATE PUBLISHED	Jul 1951		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Stanki i Instrument, No 7, 1951.

VIBRATION RESISTANCE IN MODELS 1261M AND 1261P LATHES

Models 1261M automatic and 1261P semiautomatic multispindle lathes are applied widely in a number of branches of industry where they are used for machining parts made of structural and special steels, cast iron, and brass in the form of bars or blanks.

Model 1261P semiautomatics are used in the bearing industry for machining inner and outer ball-and roller-bearing rings made of ShKh15 special bearing steel. The outer surfaces of inner roller-bearing rings are machined with form cutters made of RF1 high-speed steel, up to 40 millimeters wide, at a cutting speed of 24-32 meters per minute and with a transverse feed of 0.03-0.05 millimeter per revolution. Under these operating conditions, considerable vibration and warping of the machined surface can be seen. The warping lengthens the time required for subsequent grinding of rings.

In using wide cutter (40-50 millimeters wide) for machining structural steel (45, 40Kh, etc. steel) at low cutting speeds, in the range of 20-40 meters per minute, slight vibration occurs and the machined surface has no trace of warping.

The machining of 45 and ShKh15 steels with longitudinal feed, with the cross section of the chip from 5 to 7 square millimeters, can take place normally without any signs of vibration or surface warping.

Literature on research in the field of machine tool vibration pertains for the most part to lathes. Studies of vibration and surface quality in machining bearing steels with wide cutters and with transverse feed have not been available.

Research and tests have been conducted, therefore, on the vibration resistance of basic units of the 1261M automatic and 1261P semiautomatic under heaviest operating conditions in machining 45 and ShKh15 steels with wide cutters and with transverse feed.

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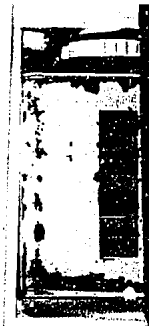

Conclusions drawn from this work are as follows:

1. Models 1261P and 1261M machine tools are adequately vibration-resistant in machining carbon steel and ShKh15 steel with longitudinal feed and with the cross section of the chip from 8 to 10 square millimeters.

2. In machining these steels with wide form cutters with transverse feed of 0.02 to 0.1 millimeter per revolution and at a speed of from 20 to 50 meters per minute, satisfactory surface quality is limited by the width of cut: for carbon steel, the cut must be no wider than 60 millimeters, and for ShKh15 steel, 25 millimeters.

3. In machining these steels on Model 1261M with the use of wide cutters, there is less surface warping than in machining on Model 1261P, other conditions being equal. Considering the similarity in the design of the units of the automatic and semiautomatic, the difference can be explained by the more rigid fastening of the workpiece on Model 1261M. The essential difference between the two machine tools is in the design of the spindle bearings.

4. The vibration resistance of spindles determines the degree of warping of machined surfaces.

With an increase in cutting speed, the amplitude of spindle vibration increases initially (maximum of 50 microns at v = 32 meters per minute) and then diminishes, achieving a minimum at v = 150 - 160 meters per minute.

An increase in axial spindle play sharply increases vibration and warping.

5. The rigidity of slides and of the spindle drum is sufficiently high as compared with the rigidity of the spindles.

6. To increase the productivity of Models 1261M and 1261P, to obtain a high surface quality of parts, and to broaden the possibilities of using form cutters for machining different steels it is necessary (a) to increase the rigidity of the spindle unit by increasing the distance between bearings, decreasing the overhang of the spindle, tightening the fit of bearing rings, and using bearings of increased rigidity; (b) to regulate strictly the axial play of the spindles within the limits of 0.02-0.25 millimeter; (c) to increase the rigidity of the device for holding the blanks on Model 1261P (chuck or mandrel); (d) to convert to the machining of steel with hard-alloy cutters at higher cutting speeds of 70 to 100 meters per minute, and with a transverse feed of 0.06 to 0.08 millimeter per revolution; (e) to increase the power of the main drive electric motor by 40-50 percent, having eliminated other weaknesses.

/A detailed description of the experiment, schematic drawings of machine-tool units, photographs, and graphs relating to the research work conducted are available in source document in CIA. For photographs and specifications of Models 1261M and 1261P, see FDD Translation No. 296 "Soviet Catalogue of Metal-Cutting Machine Tools, Part One - Lathes," 29 January 1951./

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